9-29-02

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September 28, 2000

Commissioner of Patents and Trademarks
Box Patent Application
Washington, DC 20231

Dear Sir:

Transmitted herewith for filing is the patent application of:

Inventor(s): Alberto Alvarez-Calderon F.
For: TRANSONIC HULL AND HYDROFIELD II

Enclosed are:
One (1) sheet of original drawings;
Specification;
Declaration;
Certificate of Mailing by Express Mail;
A verified statement to establish small entity status under 37 C.F.R. § 1.9 and 37 C.F.R. § 1.27 and
The filing fee has been calculated as shown below:

| FOR: | Nº FILED | | Nº EXTRA | RATE | FEE | Basic Fee - $345.00 |
|---|---|---|---|---|---|---|
| Total Claims | 12 | -20 | 0 | x 11 | 0 | |
| Indep. Claims | 7 | -3 | 0 | x 39 | 156.00 | |
| | | | | | TOTAL: | **$501.00** |

A check in the amount of five hundred one dollars ($501.00) to cover the filing fee is enclosed.

Respectfully submitted,

Adam H. Jacobs

Adam H. Jacobs
For the Firm

AHJ
Enclosures

**CERTIFICATE OF MAILING BY EXPRESS MAIL**

Express Mail mailing label № EK871700935US

I hereby certify that the original of this patent application of Alberto Alvarez-Calderon F., entitled: TRANSONIC HULL AND HYDROFIELD II, including one (1) page of drawings, the written specification and a check in the amount of five hundred one dollars ($501.00) for the filing fee thereof was mailed by Express Mail, postage prepaid, to the Commissioner of Patents and Trademarks, Box Patent Application, Washington D.C. 20231, on this 28th day of September, 2000.

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Applicant or Patentee: Alberto Alvarez-Calderon F.
Serial or Patent №
Filed or Issued:
Title: **TRANSONIC HULL AND HYDROFIELD (PART II)**

Docket № 1186-001

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 C.F.R. §§ 1.9(f) & 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 C.F.R. § 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office regarding the invention entitled: **TRANSONIC HULL AND HYDROFIELD (PART II)** described in:

[X] the patent application and specification filed herewith.
[ ] application serial number __________, filed ____________
[ ] patent number _______________, issued ____________

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 C.F.R. § 1.9(c) if that person had made the invention or to any concern which would not qualify as a small business concern under 37 C.F.R. § 1.9(d) or a nonprofit organization under 37 C.F.R. § 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below: None

*Note: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 C.F.R. § 1.27)

NAME
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NAME
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[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

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I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 C.F.R. 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

**Alberto Alvarez-Calderon F.**

[signature]
Signature of Inventor
Sept · 25 · 2000
Date

Signature of Inventor
Date

Signature of Inventor
Date

# PETITION

To the Honorable Commissioner of Patents and Trademarks
Box Patent Application
Washington, DC 20231

Your Petitioner, Alberto Alvarez-Calderon F., a citizen of Peru, citizen of the United States of America and resident of the State of California, whose residence and mailing address is 410 Fern Glen, La Jolla, California 92037, prays that Letters Patent Protection be granted to him for a

**TRANSONIC HULL AND HYDROFIELD II**

as set forth in the following specification:

**Cross-Reference to Related Application**

This application claims priority to the filing date of related patent application serial No. 08/814,418 filed March 11, 1997.

**Background of the Invention**

**1. Technical Field**

The present invention relates to improvements on Transonic Hull (TH), and transonic hydrofield (<u>TH</u>), of Application 08/814,418. More particularly, it pertains to certain relations between hydrostatic and hydrodynamic design parameters, to the relation between draft at the hull's stern, center of gravity position, speed regimes, effect of drag on hull's efficiency, and various other effects of draft at the hull's stern. The improvements have been established by means of TH/<u>TH</u> theory, and of tank and model testing, and have yielded important results for the utility of the TH invention.

**2. Description of the Prior Art**

Although certain vessels having triangular hull planform shape apparently similar in some respect to TH have been prepared in the

past (for example, those cited by the Patent Office in the examination of Application 08/814,418), these have been designed to have approximately equal drafts adjacent the stern and the bow, as in conventional ship design. The Japanese Patent 61- 125981A of Mitsubishi Heavy Industries teaches, in all its embodiments, that the draft at stern and bow of this approximately triangular hull planform are approximately equal and the same as midbody draft. In this they followed earlier design criteria, even as far back as that of U.S. Patent 23626 of 1859, which also shows equal draft at bow, stern, and midbody. The deep stern drafts with broad beams at the stern are extremely inefficient.

In both the above-mentioned patents, the location of the center of buoyancy (CB) of their hulls, and therefore the location of their centers of gravity (CG) would be, by reason of their planforms and equal drafts, at or very close to their center of planform areas and waterplane, also known as longitudinal center of flotation (LCF), which is at 66% of water line length aft of the bow, unless a bow bulb is used. This proximity of CG, CB, and LCF is usual for conventional hulls. Moreover, such prior art does not consider the effects of CB and CG location on drag under forward motion.

In respect to proximity of CG, CB, and LCF, I have discovered that their proximity as in conventional hulls is not viable for TH, because it renders this type of hull with unstable tendencies in pitch under fast motion, when subjected even to a minor pitch disturbance. Such adverse behavior is similar to a phugoid self-sustained oscillation of aircraft when its center of gravity is close to its neutral point. In a ship, such oscillations not only

increase drag, but are undesirable for structures, for cargo and for passengers, and may be dangerous.

Such fundamental problems are serious. The Mitsubishi patent teaches a solution to this problem by means of a bow bulb. Thus, it mixes a bulb technology which was developed and is useful for fat, slow ships, with a different type of hull. This adds drag, as well as volume, to their design, and the drag issue is not priority for prior art.

In contrast, TH and <u>TH</u> of Application 08/814,418 make a totally different and innovative solution: it combines, in the submerged portion of TH, a deep draft forward and a shallow draft to the rear, which normal architectural ship design would consider dangerous with an inherent dive potential unless a bow bulb were used. However, following model tests, this writer confirmed that TH theory is correct in that dive tendencies are not determined on a triangular planform. The TH solution renders an inherent distance between LCF and center of buoyancy and therefore has a center of gravity substantially ahead of the LCF. Moreover, the quantitative aspects in the relation between CB, CG, LCF, and stern draft is dependent, I have discovered in relation to lack of dive tendency and established in respect to payload, with reference to the distinctions between the hydrostatic stern condition and the stern's hydrodynamic condition in the supercritical and subcritical regimes, as is done in the present CIP patent application in respect to limits of distances between LCF, CB, CB, and effect on static draft. Furthermore, these key relations are established in the present work in relation to the hydrodynamic drag consequence of entry and exit flow angles in its various speed regimes.

**Summary of the Invention**

The invention pertains to transonic hull and transonic hydrofield. It relates to the static condition of the hull to its dynamic conditions in the supercritical and subcritical regimes, by prescribing relations between the hydrodynamic entry angle of planform to exit angle in profile, and by relating the hydrostatic stern draft to center of gravity and longitudinal center of flotation in respect to hydrodynamic drag and at pitch behavior in the supercritical and subcritical regimes, which are governed in important part by wake conditions.

## Brief Description of the Drawings

Figures **1, 2** and **3** are views of the cover planform and profile view of TH, and planview of TH of the present invention;

Figures **4**, **4A** and **5** cover specific quantifiable design parameters in accordance to present invention for the planview and profile view of TH, including relation of planform entry angle of flow and exit angle in profile of flow, and identify draft definitions; and

Figures **6A** and **6B** specify the relation between stern draft, hydrodynamic drag, and center of gravity positions.

**Description of the Preferred Embodiment**

1. Introduction and Conceptual Inquiry.

The important TH improvements of the present invention are related to TH and <u>TH</u> of my Patent Application 08/814.418 and can be best understood by a brief review of that application and the conceptual inquiry that review raises. Accordingly, Fig. 1, taken from that patent application, is a side view of TH having a hull 1 with a submerged hull portion 3 of length L, the undersurface of which is at a negative angle of approximately 3.5° relative to water level 5, with the deep draft forward. An alternative deeper submerged portion 7 makes a larger angle 1 of approximately 7°. Larger angles can also be used, for example 11°. However, the submerged portions are shown to have a shallow and virtually zero draft in side view at stern 9, in all cases exhibiting a substantially triangular profile shape of the submerged portion of the TH.

Accordingly, the planview of TH of Fig. 1 as is shown in Fig. 2, with a waterplane is substantially triangular and the centroid of its area, also called (for reasons unclear to this writer) longitudinal center of flotation LCF, is inherently at one third the length of the waterplane forward of the stern. The semi-angle of entry at bow is of small magnitude 7.1°, as shown in the drawing, even though the length- to-beam ratio is large, i.e. 4:1. The entry angle could be larger up to about 11°.

The center of gravity positions shown in Fig. 2 are $\nabla$XCG for angle $\beta$, and a larger distance $\nabla X^1$CG for larger angle $\beta^1$, both distances forward of LCG, but undefined in magnitude.

The teachings above corresponding broadly to Patent

Application 08/814,418, but do not cover important subjects related to hull efficiency. For example:

a. What is best stern draft in static case to obtain best efficiency with forward motion?

b. What are best CG positions ahead of LCF to obtain optimum efficiency as related to stern draft?

c. Until the present analysis, what is the important optimized relation between the angle of entry of the planview, which minimizes formation of bow wave, and undersurface exit angles $\beta$ and $\beta^1$, which counter the formation of a stern wave?

Consider Fig. 3, which shows the two hydrodynamic regimes of TH in motion, the supercritical <u>TH</u> regime, with rays 17 and flat wake 21, corresponding to a speed/length greater than approximately 1.25, and the subcritical <u>TH</u> regime with wake transition borders shown as dash line 19, corresponding to a speed-to-length less than approximately 1.25. The speed-to-length ratio is in knots divided by square root of length in feet, and the values mentioned are somewhat dependent on ratio of weight-to-length, in which weight is in tons and length is actually the third power of length in feet divided by 100. These different speed regimes have important relation to static draft at stern, and in turn to weight-to-drag ratio, i.e., hydrodynamic efficiency; that is, it depends on CG position and stern draft.

2. TH/TH Design Parameters of the Present Invention.

Theoretical considerations, backed up by test data of models, establish in the present invention my discovery that there are important quantifiable relations between LCF, CB, CG, stern draft, planform angle of entry and exit profile angle, stern draft and performance of TH, as is specified below in reference to Figs. 4-6.

a) Fig. 4 shows depth of transom 21 in static conditions, which in turn depends on CG's location relative to LCF shown in Fig. 5, and alters angle of undersurface to, say, $\beta^{11}$ value shown in Fig. 4, which is different from hydrodynamic $\beta^{1}$ or $\beta$ in earlier figures.

b) The relation LCG-LCB = ∇XCG shown in Fig. 5 governs to an important extend the speed-to-length ratio at which transition from subcritical to supercritical occurs, as dependent on length 23 in Fig. 3, and on beam 25 in Fig. 5, thus establishing lower speed regime range and upper speed range of efficient operation of TH.

c) Moreover, there is a critical minimal distance ∇XCG between CG and LCF, shown in Fig. 5, which governs ∇Z in Fig. 4 and is thus related to the performance parameter weight/drag. Moreover, there is another minimum value of ∇XCG called herein ∇XCG critical, which is equivalent to a neutral point for pitch stability, in analogy to the neutral point which governs pitch stability of aircraft. If for TH's archetype ∇XCG in Fig. 5 is made too small, pitch oscillations

similar to phugoids in aircraft will be excited by minimal external pitch disturbances.

d) Another relation of importance in respect to stern wake, $\nabla Z$, and drag is the shape relation of in planform and profile of TH, as these also govern, $\nabla Z$, $\nabla XCG$, LCF, etc., and the hull shapes are governed by two important angles: the planform entry angle $\alpha^*$ and the exit profile angle $\beta^*$.

Thus, in my discoveries, according to <u>TH</u> theory and <u>TH</u> experiment, I have established and confirmed through TH model tests the critical relation of $\nabla Z$ in static conditions such as is shown by draft 21 on static TH 24 in Fig. 4 with undersurface angle II, to location of center of CG forward of centroid of area at a distance $\nabla XCG$, as shown in Fig. 5. The distances in respect to the stern are shown in Fig. 4 as LGF of L/3 and LCG as somewhat larger, all these distances measured from stern forward, which respond to the inherent formulation of TH, rather than from forward post to the rear, as is usual for conventional ships.

The effect of static $\nabla Z$ on hydrodynamic drag under forward motion is shown in Fig. 6A, with relative drag changes in the vertical axis, and the static stern draft $\nabla Z$ in the horizontal axis, expressed as fractions of stern's beam 25 in Fig. 5, that is, as $\nabla Z/B$.

The corresponding relation between the position of center of gravity and stern's draft is shown in Fig. 6B, in which the adverse case of old art, namely, equal drafts at bow and stern is numerically equal to $\nabla Z/B = 0.081$.

It is seen in Fig. 6 that if static draft is equal to 0.08 of beam to which corresponds a CG at the centroid of waterplane area for equal stern and bow draft, the hydrodynamic drag is very large, and the concepts of subcritical and supercritical hydrodynamic regimes of TH would not apply or make sense.

In accordance to the test data of this invention, in the supercritical regime at $v/\sqrt{L} \approx 1.45$, the static draft should be reduced by a factor of 4 from 0.08 to approximately 0.02. Then the hydrodynamic payoff is a drag is reduction by 34%, which is extremely important for range and speed, apart from the large gains of stability in pitch. Further reductions of stern draft at $v/\sqrt{L} \approx 1.45$ show an increases of drag.

And in accordance to tests of the TH invention, in the subcritical regime at $v/\sqrt{L} \approx 1.05$, the static draft should be reduced from 0.08 to 0.01, a factor of 8 compared to old art. The hydrodynamic drag payoff is then a reduction of drag by approximately 51%, again extremely important for range and speed, apart from the stability gains, also very important.

As the parameters described in Figs. 4 to 6B are dependent on planform and submerged profile angles which govern volume distribution, it is very important to maintain the proper relation between planform entry angle shown in Fig. 5 to the dynamic exit angle II that applies to the exit angle $\beta^*$ shown in Fig 4a, between the rearmost portion 31 of TH's undersurface, adjacent the stern, and a line which, parallel to the water level, intersects the lower corner of the transom in the design speed envelope of TH. The $\alpha^*\beta^*$ relationship that provides the most efficient hydrodynamic results covers $\beta^*$ values from approximately one half $\alpha^*$ to higher value

which approximate α*. However, β* can be increased for hulls of large displacement in which a forward portion of the undersurface is parallel to the static waterline due to draft limits in harbors, for example, as shown in Fig. 13C of Application 08/814,418. In such a case, β* can exceed α*.

The range of stern draft of 0.01 to 0.02 for best hydrodynamic performance of Fig. 6B correspond to longitudinal position of the center of gravity which varies from about 0.44L for smaller stern draft to about 0.41L for the larger stern draft, but in both cases with a significant negative angle in TH's undersurface, as shown in Figs. 4 and 4A. This range has the added and important benefit of having increased pitch stability.

It is possible to extend the range of LCG forward from that of Fig. 6B, for example to 0.48L, by accepting an angle larger than angle II in Fig. 4, if draft forward is not excessive, for example, in relation to water depth.

It is also possible to use a shorter LCG from stern, for example, to 0.385, but such choices start running into pitch stability problems, and those depend on mass distribution on a full size boat which need not be that used for model tests, and therefore the pitch stability area should be investigated and tested full size by a licensed boat builder as his responsibility.

The numerical values of the design criteria mentioned above are representative for the hull characteristics reviewed, and may be adjusted for specific TH hull shapes, thrust line positions, and other design features.

The present invention pertains to hydrodynamic conditions that require propulsion systems to achieve the specified span-to-length

ratio with which the draft variations and related parameters are attained. One important ratio is 1:25. Accordingly, Fig. 4 shows an engine 31 driving by means of inclined shaft 33 a propeller 35 with a thrust line approximately parallel to the remote waterplane. In the higher speed regimes, for example, approximately at or above ratio of 1:45 shown in Fig. 6A, water jets can be used. This alternative is shown in Fig. 4A having a bottom water intake 39 for water jet 37 which exits at 41, in this case ahead of transom to decrease for military purposes white water in wake, which would occur if the exit of the water jet is at or above water level 31.

The specifications and drawings pertain to hydrodynamics, TH shapes and propulsion and does not cover structures or controls. Model tests are not sufficient for determining stability of full size manned TH or unknown weight or other safety related matter. These matters should be investigated and determined solely by licensed manufacturers, who have the sole responsibility in such matters and are obviously outside the scope of the present patent application and its claims, presented below.

Finally, it is to be understood that changes can be made on the drawings and specifications without departing from the teachings as covered in the claims of the invention.

I claim:

**1.** A wave reducing and eliminating ship hull comprising:

a generally triangular hull having a pointed narrow bow portion and a stern portion wider than said bow portion;

said hull including generally rectilinear diverging sides extending substantially from said bow to said stern; and

said hull having a draft adjacent said bow deeper than the draft adjacent said stern.

**2.** The ship hull of claim **1** wherein said bow portion of said hull is generally free of depending structures.

**3.** A transonic hull having a submerged portion with a bow, a stern, a waterplane which in static conditions and in motion has an approximately triangular shape with an apex adjacent said bow and a base adjacent said stern, said submerged portion in said static condition having a deep draft adjacent said bow and a draft adjacent said stern no greater than approximately 4% the width of said base, with said draft at said stern decreasing by virtue of the motion of said hull on the water towards zero relative to the water flowing adjacent and downstream from said stern.

**4.** A transonic hull having a bow, a stern, a length and power means to move said TH in the water at supercritical and subcritical speed regimes, said hull when in motion in displacement

mode having

a) A submerged portion with a generally triangular waterplane with apex adjacent said bow and a base adjacent said stern.

b) A profile with a deeper draft adjacent said bow and no bulb, and substantially zero draft adjacent said stern relative to water flowing smoothly downstream below said stern.

c) Said hull further characterized in having, when floating static in water, a draft adjacent said stern no greater than substantially 4% of the width of said base.

**5.** The transonic hull of Claim **4** in which said draft adjacent said stern is substantially eliminated in relation to water level adjacent and aft of said stern when propelled by said power means at speed-to-length greater than 1.25.

**6.** A transonic hull having a weight, a submerged portion, a bow, a stern, a generally triangular waterplane with a longitudinal length and an apex adjacent said bow, and a center of area of said waterplane, with the position of the center of gravity of said weight being located at a longitudinal distance forward of said center of area at least as large as approximately 1.5% of said longitudinal length, whereby hydrodynamic drag is minimized.

**7.** The transonic hull of Claim **6**, with said longitudinal distance being no greater than approximately 10% of said longitudinal length.

**8.** A transonic hull having a weight, a submerged portion, a bow, a stern, a generally triangular waterplane, with a longitudinal length, an apex adjacent said bow, and a base adjacent said stern, and a center of area of said waterplane, with the position of the center of gravity of said weight being located at a longitudinal distance forward of said center of area at least as large as approximately 5% of the length of said base, whereby hydrodynamic drag is minimized.

**9.** The transonic hull of Claim **8**, with said longitudinal distance being no greater than approximately 10% of said longitudinal length.

**10.** A transonic hull having a bow, a midbody, a stern propulsive means having water impeller means capable of imparting sustained motion at a sustained speed-to-length ratio at least as large as substantially 1.25, said hull further characterized in having a submerged portion with a waterplane of generally triangular shape with apex adjacent said bow, a base adjacent said stern, and a profile view with a deep draft away from said stern and adjacent said midbody, and substantially zero draft at said stern relative to water flow downstream from below said stern.

**11.** A transonic hull having a bow, a stern, an undersurface, and an approximately triangular waterplane at water level with an apex angle adjacent said bow; said transonic hull being further characterized in that the included exit angle in side view between the rearward undersurface portion adjacent said stern and a line

parallel to water level intersecting the lower corner of said stern being no greater than approximately said apex angle.

**12**. The structure of Claim **11** in that said exit angle is approximately 60% of said apex angle.

## Abstract of the Invention

A wave reducing and eliminating ship hull including a generally triangular hull having a pointed narrow bow portion and a stern portion wider than the bow portion, the hull including generally rectilinear diverging sides extending substantially from the bow to the stern. The hull further includes a draft adjacent the bow deeper than the draft adjacent the stern, and the bow portion of the hull is generally free of depending structures.

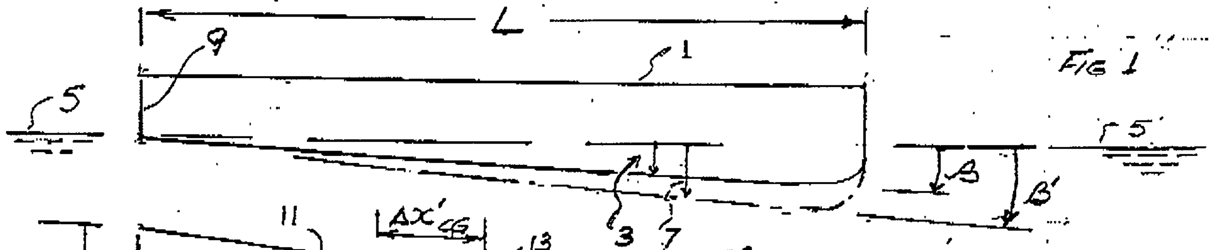



FIG 1

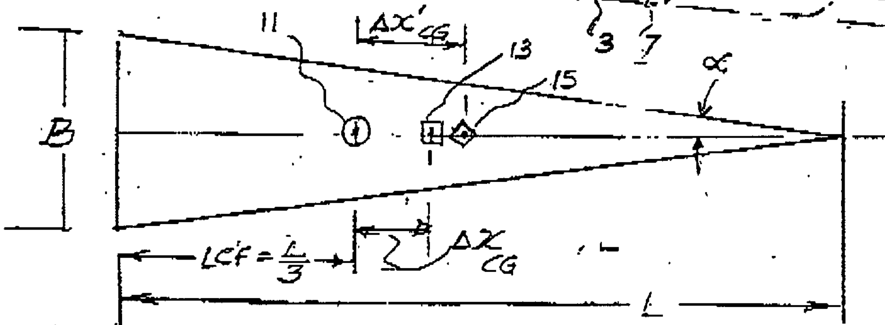



FIG 2

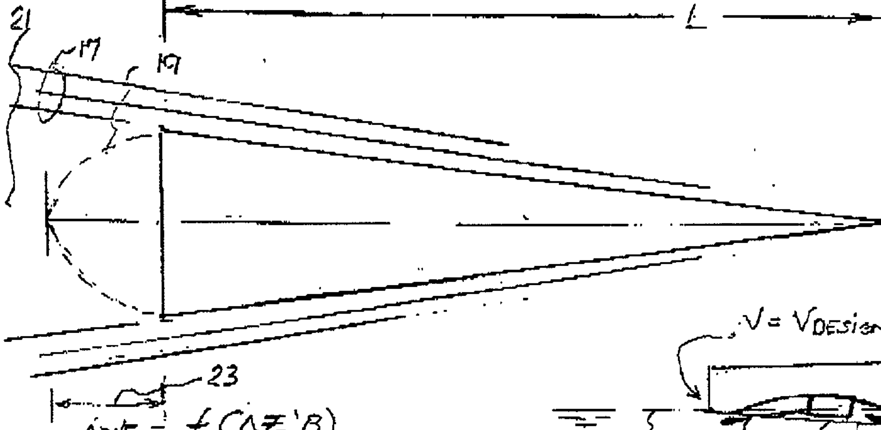



FIG 3

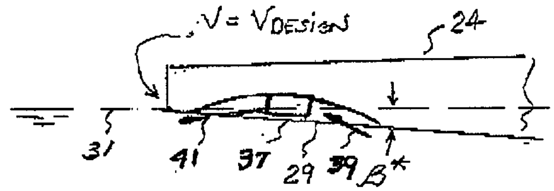



FIG 4A

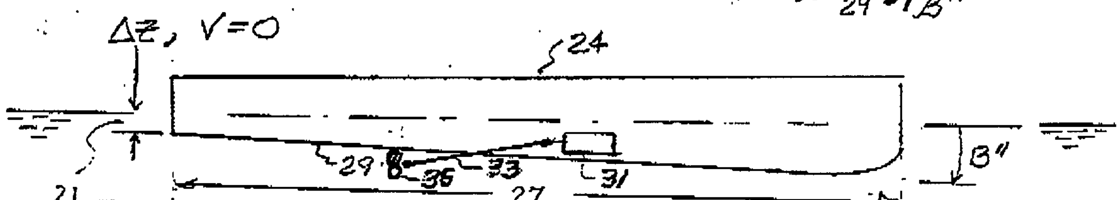



FIG 4

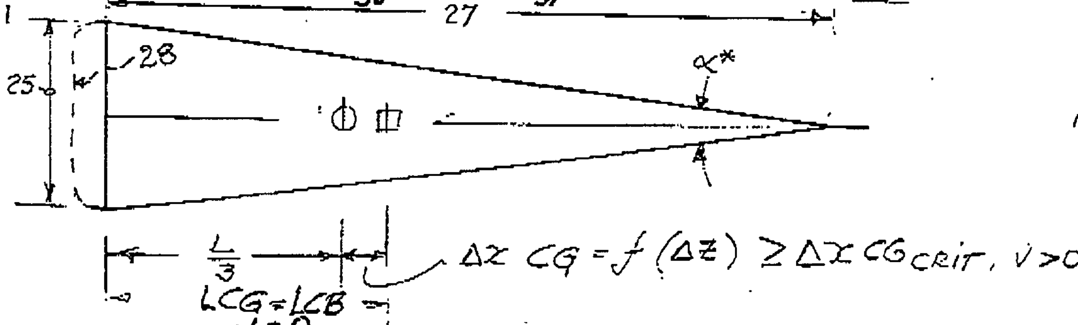
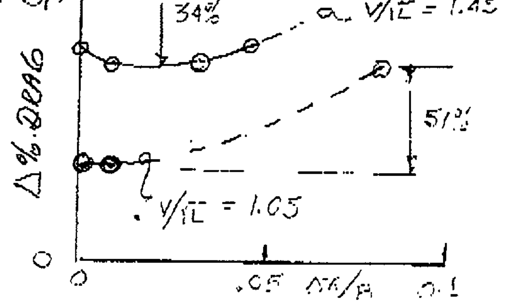



FIG 5

FIG 6A



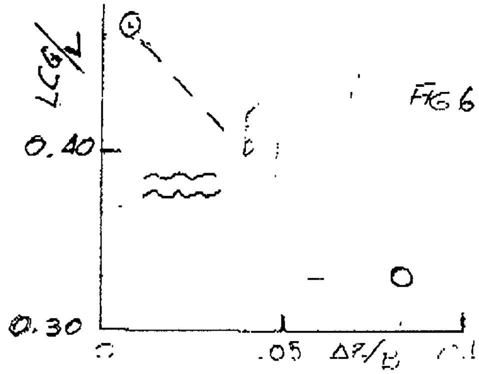




FIG 6B

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Alberto Alvarez-Calderon F., the above named Petitioner, declares that he is a citizen of Peru and a resident of the United States in the State of California, with a residence and post office address of 410 Fern Glen, La Jolla, California 92037, that he verily believes himself to be the original, first and sole inventor of the subject matter which is described and claimed in the annexed specification entitled TRANSONIC HULL AND HYDROFIELD (PART II) and for which a patent is sought;

that he does not know and does not believe that the same was ever known or used in the United Stats of America before his invention thereof or patented or made the subject of an inventor's certificate or described in any printed publication in any country before his invention thereof, or more than one year prior to the date of said application, or in public use or on sale in the United States more than one year prior to the date of said application;

that said invention has not been patented or made the subject of an inventor's certificate before the date of said application in any country foreign to the United States on an application filed by him or his legal representatives or assigns more than twelve months prior to the date of said application;

that said invention was the subject of a utility patent application Serial No. 08/814,418 filed on March 11, 1997 and that the instant application claims priority based on the cited utility patent application;

that he acknowledges a duty under 37 C.F.R § 1.56 to disclose information he is aware of which is material to the examination of the application, that he has reviewed and understands the contents of the specification, including the claims, as amended by any amendment specifically referred to in the oath or declaration, and that no application for patent on said invention has been filed by him or his representatives or assigns in any country foreign to the United States, except as follows: None.

And he hereby appoints the Law Offices of Adam H. Jacobs, comprising Adam H. Jacobs, Registration No. 37,852, 1904 Farnam Street, Suite 726, Omaha, Nebraska 68102, as his attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

The undersigned Petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statement may jeopardize the validity of the application or any patent issuing thereon.

Alberto Alvarez-Calderon F.

Date: Sept-25-2000